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Abstract

This note argues that most academic key sector analyses provide misleading information for policy-makers, as they ignore the other side of the coin, namely, the tax cost of generating a sector's large forward and backward linkages. This other side is important because the tax cost of the necessary policy measures is unequal across sectors and unequal across backward and forward linkages. Only the net backward and the recently defined net forward linkage measure make a first, be it minimal, attempt to incorporate this other side of the coin. Serious policy advice should be based on an adequate discussion of the other side of the coin.

Key words: key sectors, net linkages, tax cost, supply-driven input-output model

JEL codes: R58, O10, C67

1. Introduction

In the fields of regional economics and development economics many different measures have been proposed to identify so-called key sectors, which are mostly defined as sectors with a high potential of spreading growth impulses throughout the whole economy (see Miller & Blair, 2009, and Temurshoev & Oosterhaven, 2014, for recent overviews). The core idea of this literature is that sectors with, both directly and indirectly, relatively large intermediate purchases (i.e., *backward* linkages) as well as relatively large intermediate sales (i.e., *forward* linkages) will do so most effectively (see Hirschman, 1958, for a first non-spatial account, and Perroux, 1961, for a first spatial account). Porter (1990) further developed this idea by adding three other sets of conditions that in his view are needed to properly define a key sector or key cluster of industries.

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The additional conditions suggested by Porter already indicate that selecting key sectors for policy purposes should include more than just measuring the size of a sector´s forward and backward linkages. However, also Porter only considers the *social benefits* of stimulating the key sectors chosen by his analysis, and not the social cost. Here, we want to discuss this other side of the coin, namely, the *policy cost* of stimulating the sector chosen.

2. Unit tax cost of sector stimulation

This other side of the coin is important, because identifying key sectors *only* by means of the size of their linkages can only be based on the assumption that the policy cost of stimulating a sector are equal across sectors, and equal across stimulating forward and stimulating backward linkages. Unfortunately, this assumption is entirely implicit in the huge literature on this topic, which simply views the size of these linkages as a good proxy for the social impact of stimulating the sector at hand. This is unfortunate, because this assumption will seldom be correct.

To start with, stimulating large sectors is definitely more costly than stimulating small sectors. This means that key sector measures at least need to be corrected for sector size to be useful for the policy selection purpose. Next, it is not evident that even the policy cost of stimulating equally sized sectors will be the same across sectors. Further, most studies use linkage measures defined in terms of gross output. To be relevant to policy formulation, however, key sectors should be defined by means of measures that reflect the real policy goals, such as income generation, job creation or reduction of CO2 emissions (see Oosterhaven, 1981, ch. 5, for an early application of forward and backward employment linkages, and Lenzen, 2003, for a general discussion).

Finally, and most importantly, generating the benefits of large backward linkages needs demand stimulating type of measures, whereas generating the benefits of large forward linkages needs productivity enhancing (i.e., price reducing) type of measures (see the Appendix for the latter argumentation). Obviously, the cost of these quite different policy measures will not be the same per unit of potential benefit, i.e., per linkage measure. Hence, selecting key sectors requires much more analysis than only establishing which sectors have the largest forward and backward linkages. In view of this it would be helpful if the proliferation of key sector measures in the literature could be halted.

This proliferation partly reflects methodological improvements, such as the replacement of *direct* backward linkages (Chenery & Watanabe, 1958) with *total* backward linkages, as measured by the column sums of the Leontief-inverse (Rasmussen, 1956), or the replacement of the row sums of the Leontief-inverse (Rasmussen, 1956) with the row sums of the Ghosh-inverse in the case of total *forward* linkages (Beyers, 1976; Jones, 1976). For another part, however, the proliferation is due to the different labelling of the same measure in independently written, seemingly unrelated studies. Thus, we have the output-to-output multiplier (Miller & Blair, 1985), which is equivalent to the total flow multiplier (Szyrmer, 1984, 1992), which is equivalent to the hypothetical extraction (HE) of whole sectors from an economy (Paelinck et al., 1965; Strassert, 1968; Schultz, 1977). The last equivalence was first indicated by Szyrmer (1992) and recently proven by Gallego & Lenzen (2005) and Temurshoev (2010). Note, however, that HE offers more flexibility than generating only total extraction multiplier measures, as it allows extracting any subset of transactions instead of only deleting full rows and columns from an input-output (IO) table (Miller & Lahr, 2001).

Finally, it is important to note that the majority of all linkage measures tries to capture the same basic concept, namely the one-sided dependence of the rest of the economy (RoE) on the sector at hand, in terms of the indicator chosen (output, employment, income, CO2, etc.). This is why the outcomes of all backward linkages are mutually quite similar, while the same holds for all forward linkages (Temurshoev & Oosterhaven, 2014). The only exception is the *net* backward linkage interpretation (Oosterhaven, 2007) of the net multiplier concept (Oosterhaven & Stelder, 2002). The obvious reason for this deviation is that this measure is the only one that captures the two-sided nature of sectoral dependence, by taking the ratio of the dependence of the RoE on the sector at hand with regard to the dependence of that sector on the RoE (Dietzenbacher, 2005).

The net backward linkage, also represents the only linkage measure that tries to take the cost of stimulating the sector at hand into account, as the net backward linkage equals the standard (gross, i.e.,) total backward linkage times the share of exogenous final demand in total output, which reflects that a relatively large-sized final demand is more easily stimulated than a relatively small-sized final demand (Oosterhaven, 2007). The same holds for the new *net* forward linkage (Termushoev & Oosterhaven, 2014), which equals the standard (gross, i.e.,) total forward linkage time the share of exogenous primary inputs in total inputs, which reflects the potential cost of stimulation the exogenous variable in the supply-driven IO model (Ghosh, 1958). The latter reflection, however, is much less evident than the one in case of the net backward linkage (see the Appendix).

3. Conclusion

Hence, considering the other side of the coin of almost every key sector analysis implies considering its hidden assumption, namely, that the per unit tax cost of stimulating the linkage at hand is equal across sectors and equal across generating backward and generating forward linkages. Instead of ignoring this assumption, a sensible selection of key sectors requires specifying the policy measures that will have to be used to stimulate demand and supply sector-by-sector, along with their unit tax cost. Obviously, the latter especially requires paying close attention to the fundamentally different multiplier mechanisms that are implied when using backward linkages as opposed to stimulating forward linkages, as detailed in the Appendix.

Appendix. Note on the causal interpretation of backward and forward linkages

The causal interpretation of a sector's total *backward* linkages is relatively straightforward, as it can only be based on the demand-driven input-output (IO) *quantity* model (Leontief, 1941). In that model, any change in the column vector with exogenous final demand $\mathbf{y}$ leads to an equally large change in the total output vector $\mathbf{x}$, which in turn leads to a proportional increase in the demand for all its intermediate inputs $\mathbf{Ay}$ and all its primary inputs $\mathbf{Cy}$, where $\mathbf{A}$ and $\mathbf{C}$, respectively, represent the matrices with per unit intermediate input and per unit primary input (i.e., purchase) coefficients.[1] Changes in intermediate demand, in turn, lead to equally large changes in total output $\mathbf{x}$, and so on. The solution to the model thus reads as: $\mathbf{x} = \mathbf{I}\ \mathbf{y} + \mathbf{A}\ \mathbf{y} + \mathbf{A}^2\ \mathbf{y} + \mathbf{A}^3\ \mathbf{y} + \ldots = (\mathbf{I} - \mathbf{A})^{-1}\ \mathbf{y}$, where $\mathbf{L} = (\mathbf{I} - \mathbf{A})^{-1}$ is the so-called Leontief-inverse. The column sums of this inverse represent the most popular *total* backward linkage measure.

The causal interpretation of a sector´s *forward* linkages is more complex. The size of the *total* forward linkages of a certain industry, nowadays, is practically always measured by the row sums of the so-called Ghosh-inverse $\mathbf{G} = \mathbf{I} + \mathbf{B} + \mathbf{B}^2 + \mathbf{B}^3 + \ldots = (\mathbf{I} - \mathbf{B})^{-1}$, where $\mathbf{B}$ represents the matrix with pure quantity intermediate output (i.e., intermediate sales) coefficients. This inverse is derived from the solution of the supply-driven IO model, first formulated by Ghosh (1958). The causal interpretation of his proportional output allocation model, however, is rather problematic.

In case of a market economy, the original *quantity* interpretation of the supply-driven IO model has been shown to be based on the implausible assumption of a single homogeneous input for each sector, which implies that cars can drive without gasoline and factories can work without labour (Oosterhaven, 1988, 2012). Nowadays, the only generally

[1] If the latter are measured by means of the base year monetary values from an IO table, then $\mathbf{i}'\mathbf{A} + \mathbf{i}'\mathbf{C} = \mathbf{i}'$ and thus $\mathbf{i}'\ \mathbf{C}\ (\mathbf{I} - \mathbf{A})^{-1} = \mathbf{i}'$. i.e., the sum of the primary input multipliers of exogenous final demand then equals one.

accepted causal interpretation of the supply-driven IO model is the Leontief *price* model interpretation of the Ghosh model (Dietzenbacher, 1997). In this interpretation, the row sums of the Ghosh-inverse $(\mathbf{I} - \mathbf{B})^{-1}$ measure the increase in the economy-wide value of output due to a unit increase in the value of a specific industry´s primary inputs *solely* due to the price parts of both values.

To clarify the causality involved in this interpretation, one thus needs to look at the solution of the Leontief *price* model (e.g., Oosterhaven, 1996): $\mathbf{p}' = \mathbf{p}_v' \mathbf{C} (\mathbf{I} - \mathbf{A})^{-1} = \mathbf{p}_v' \mathbf{C} (\mathbf{I} + \mathbf{A} + \mathbf{A}^2 + \mathbf{A}^3 + \ldots)$, where $\mathbf{p}'$ and $\mathbf{p}_v'$ represent the row vectors with (index) prices of, respectively, total output by sector and primary input by type (e.g., capital, labour and imports). The causal interpretation of this solution is that any change in one of the exogenous primary input prices for a certain sector $\mathbf{p}_v'$ leads to a change in that sector´s endogenous total output price $\mathbf{p}'$, of course, weighted by the share of that primary input in the total input of that sector, i.e., by the coefficients in the matrix $\mathbf{C}$. Next, this direct output price change $\mathbf{p}_v' \mathbf{C}$ subsequently leads to price changes in all *downstream* sectors that use this sector´s output as an intermediate input. The size of these further price changes is, of course, determined by the weight of that intermediate input in the total input of each purchasing sector, i.e., by the coefficients in the matrix $\mathbf{A}$. The resulting *first round* downstream price changes thus equal $\mathbf{p}_v' \mathbf{C} \mathbf{A}$, and the second round downstream price changes subsequently equal $\mathbf{p}_v' \mathbf{C} \mathbf{A}^2$, and so on. Forward linkages in the Ghosh model thus indicate the endogenous economy-wide impact on the *value* of total output due to a change in the *price-part* of the value of the primary inputs of the sector at hand.

Quantities in the price interpretation of Ghosh model, just as in the Leontief price model, do not change. The pertinent question therefore is: what type of policy measures may induce a change in the *quantity* of output that is equal to or at least proportional with the change in the *value* of total output as predicted by the price interpretation of the Ghosh model.

The answer best starts at the end by assuming that all purchasing agents (industries as well as final demand categories) have a price elasticity of demand equal to -1, because in that case we get an equality in absolute size between the increase in a sector´s output quantity and an decrease of that sector's output price, which leads to an economy-wide output volume increase that, in absolute terms, is equal to that sector´s policy-induced primary input price decrease multiplied with its total forward linkage measure.

The remaining and most important question then is what type of policy measures may induce a decrease in the primary input prices of the sector at hand. Obviously, these may be labour or capital or import subsidies, or measures such as schooling and R&D support that increase a sector´s labour or capital productivity, which are precisely the type of policy measures mentioned in the main text.

References

Beyers, W.B. (1976) Empirical identification of key sectors: Some further evidence. *Environment and Planning A* 8/2: 231-36.

Chenery, H.B. & T. Watanabe (1958) International comparisons of the structure of production. *Econometrica* 26, 487–521.

Dietzenbacher, E. (1997) In vindication of the Ghosh model: a reinterpretation as a price model. *Journal of Regional Science* 37, 629–651.

Dietzenbacher, E. (2005) More on multipliers. *Journal of Regional Scienc*e 45, 421-6.

Gallego, B. & M. Lenzen (2005) A consistent input-output formulation of shared producer and consumer responsibility. *Economic Systems Research* 17, 365-391.

Ghosh, A. (1958) Input-output approach to an allocative system. *Economica* 25, 58–64.

Hirschman, A. (1958) *The Strategy of Economic Development*. New Haven: Yale University Press.

Jones, L.P. (1976) The measurement of Hirschmanian linkages. *Quarterly Journal of Economics* 90, 323-33

Lenzen, M. (2003) Environmentally important paths, linkages and key sectors in the Australian economy. *Structural Change and Economic Dynamics* 14, 1–34.

Leontief, W.W. (1941) *The Structure of American Economy, 1919-1929: An Empirical Application of Equilibrium Analysis*. Cambridge: Cambridge University Press.

Miller, R.E. & P.D. Blair (1985) *Input-output analysis: foundations and extensions*. Prentice Hall, Englewood Cliffs, New Jersey.

Miller, R.E. & M.L. Lahr (2001) A taxonomy of extractions. In: M. L. Lahr and R. E. Miller (eds.) *Regional Science Perspectives in Economics: A Festschrift in Memory of Benjamin H. Stevens*. Amsterdam: Elsevier Science, 407–441.

Oosterhaven, J. (1981) *Interregional Input-Output Analysis and Dutch Regional Policy Problems*. Aldershot: Gower.

Oosterhaven, J. (1988) On the plausibility of the supply-driven input-output model. *Journal of Regional Science* 28, 203–217.

Oosterhaven, J. (1996 Leontief versus Ghoshian price and quantity models. *Southern Economic Journal* 62, 750–759.

Oosterhaven, J. (2007) The net multiplier is a new key sector indicator: reply to De Mesnard's comment. *Annals of Regional Science* 41, 273-283.

Oosterhaven, J. (2012) Adding supply-driven consumption makes the Ghosh model even more implausible. *Economic Systems Research* 24/1: 101-11.

Oosterhaven, J. & D. Stelder (2002) Net multipliers avoid exaggerating impacts: with a bi-regional illustriation for the Dutch transportation sector. *Journal of Regional Science* 42, 533–543.

Porter, M.E. (1990) *The Competitive Advantage of Nations*. New York: Free Press.

Paelinck, J., J. de Caevel & J. Degueldre (1965) Analyse quantitative de certaines phénomènes du développment régional polarisé: Essai de simulation statique d'itérarires de propogation. In: Problémes de Conversion Éconmique: Analyses Théoretiques et Études Appliquées. Paris, 341–387.

Rasmussen, P. N. (1956) *Studies in Inter-Sectoral Relations*. Amsterdam: North-Holland.

Schultz, S. (1977) Approaches to identifying key sectors empirically by means of input-output analysis. *Journal of Development Studies* 14, 77–96.

Strassert, G. (1968) Zur Bestimmung strategischer Sektoren mit Hilfe von Input-Output Modellen. *Jahrbücher für Nationalökonomie und Statistik* 182, 211–215.

Szyrmer, J. M. (1984) *Total Flow in Input-Output Models*. PhD Thesis, School of Arts and Sciences, University of Pennsylvania, PA.

Szyrmer. J. M. (1992) Input-output coefficients and multipliers from a total-flow perspective. *Environment and Planning A* 24: 921-37.

Temurshoev, U. (2010) Identifying optimal sector groupings with the hypothetical extraction method. *Journal of Regional Science* 50, 872–890.

Temurshoev, U. & J. Oosterhaven (2014) Analytical and Empirical Comparison of Policy-Relevant Key Sector Measures. *Spatial Economic Analysis* 9/3, 284-308

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